DIVISION OF PHARMACOLOGY and
PESTICIDE BRANCH

February 11, 1957

DIVISION OF FOOD

Evaluation of HCN residue data submitted in Petition No. 94.

Buckwheat, Oats, and Sorghum Grains.--The petition seeks extension to these grains of the 25 ppm tolerance established under Petition No. 38 for a number of products, including wheat and other small grains. No residue data obtained specifically on buckwheat, oats, or sorghum grains are submitted, but it is proposed that conclusions based on evidence in Petition No. 38, respecting residue in wheat and other small grains, be applied to them.

This is a parallel to Petition No. 75 which sought extension to these grains of the tolerance for HCN as residue of calcium cyanide, through similar application to them of conclusions drawn from data on wheat and other small grains. We did so in that case. Residue considerations here are identical and we conclude, by identical reasoning, that 25 ppm is maximum residue expectation from fumigation of these grains with HCN when they enter the channels of commerce. Under his request for a tolerance for spices, petitioner has included sesame, a small grain as well as a "spice." The data are indicative that sesame would incur no more than a 25 ppm residue. We accordingly recommend that sesame be considered as a small grain for this purpose and that the 25 ppm tolerance apply to it.

Spices.--The petitioner additionally seeks a tolerance of 100 ppm for HCN in spices generally. Pesticide Regulation Section of USDA submits the opinion that while 100 ppm is an expected residue in case of some spices when HCN is used as proposed, such tolerance would not necessarily be met by other varieties of spice. We agree that the data do so indicate.

While there are exceptions, a characteristic of most spices is that they contain a volatile component, which is usually responsible for their pungency. That such component is generally retained in spice tissue, to greater or lesser extent, and for long periods, is indicative that their tissue is relatively retentive for absorbed volatile substances, in comparison with other vegetable tissue. Hence it is not surprising that many spices exhibit marked absorption and retention of HCN.

Petitioner lists 35 varieties of spice (in addition to sesame), but for eight of these no residue data whatever are provided. Where data are available and adequate, they indicate that residue expectancy for various spices may differ widely.

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Those that are apparently less absorptive and those that, while fairly absorptive are less retentive, and could be expected to meet a 100 ppm tolerance after HCN fumigation in the manner proposed--up to 1-1/2 lb HCN per 1000 cu ft for 16-20 hours, followed by minimal aeration for 24-72 hours--are:

turmeric	nutmeg	celery seed
clove	ginger	red pepper
cumin	bay	coriander

Those that could be expected to range only moderately above 100 ppm after 24-72 hours' aeration, and diminish to that level after an additional 72 hour (6 days total) aeration, are:

black pepper	white pepper	mace
caraway	allspice	

We include mace in this group because, while data on it are inadequate for independent evaluation, it is a spice closely associated with nutmeg, growing as a separate tissue next to the surface thereof, and what data are submitted on it are not widely dissimilar to those on nutmeg. Considered together, the two sets of findings suggest that an only moderately longer interval of aeration (6 days total) would safely suffice to reduce the residue of mace to 100 ppm.

A quite different residue picture is depicted by data on most of the herb spices, those on cassia, those on paprika, and, in lesser distinction, those on dill and anise.

The latter two could be expected to range between 100 and 150 ppm after 6 days' aeration. Carrying residue of an order of at least that magnitude would be poppy, thyme, and sage, on which data are inadequate for independent evaluations but sufficient, in light of findings on other seeds (in case of poppy) and on other herbs (in case of thyme and sage) to indicate their maximum residue expectancy to be in excess of 100 ppm after 6 days' aeration.

Data on paprika indicate that it is highly absorptive, and those on chili, a similar pod capsicum, are indicative of high residue retention. Considered together (since neither set is adequate for independent evaluation) the data indicate that residue in these pod peppers would range, roughly, between 100 and 200 ppm, after 6 days' aeration.

The findings on cassia are similarly indicative of a residue between 100 and 200 ppm after 6 days' aeration. While no data are provided for cinnamon, it seems reasonable to expect a comparable residue in this quite similar bark.

The analytical evidence on rosemary, savory, and marjoram signifies expectation of residue between 150 and 200 ppm, after 6 days' aeration.

That on oregano and basil dictates the conclusion that their residue could run between 200 and 250 ppm after 6 days' aeration.

Of the 36 spices tested by petitioner, this leaves seven--fennel, mustard, cardamon, fenugreek, spearmint, peppermint, and parsley--on which no data are provided, and to which there is no apparent opportunity to apply conclusions drawn from other spices.

Some of the data represent samples stored in tin, residue of which, at first blush, might not be expected to diminish with time. Other data represent samples exposed in open trays, from which accelerated escape of HCN residue is an avident expectation. Where comparison can be made with data representative of storage conditions simulating those in practice, however, it affords no consistent realization of either expectation. We have not, therefore, taken the manner of storage of samples into account, in our evaluation of the data. Quite evidently, in the part per million range of magnitude, escape of HCN from the tissue itself constitutes its elimination as residue. This, of course, contributes realism to the contemplation of a 6-day aeration interval. It suggests that even if the spice is not physically set aside for such interval, the time lapse that must almost inevitably occur between fumigation and the entry of the produce into channels of trade, however packaged, would serve to reduce the residue to a maximum of 250 ppm in the case of any of the spices on which data are provided, and probably any others as well.

One safeguard against harm from any exception to this expectation is the fact that a major proportion of the total volume of spice in commerce is sold in ground condition. Data presented indicate widely varying effect of grinding; but show that elimination of residue is always a substantial consequence.

Another safeguard is the fact that cooking will invariably foster escape of HCN residue.

By all odds, however, the most prominent safety factor is that the essential value of spices--their pungency--prevents their use in food in greater than nominal proportion--usually not in excess of 1% and never more than 2 or 3%. Even in case of such a mild herb as parsley, where pungency might not be a barrier to use of a larger proportion, the appearance of the serving would be.

On the whole it would appear only realistic to focus consideration of the safety of residue from HCN fumigation of spices on an expectation that the maximum contributed to food would be of the order of 7 or 8 ppm and would usually be only a minor fraction of that level. Approximately that much can occur naturally in some common foods such as celery. If our estimates are 100% in error, the maximum from fumigated spice in food as served would yet be less than often is present in lima beans.

Under these circumstances, a case for an exemption from the requirement for a tolerance could persuasively be argued. However, it is to be noted that such argument at this time, applied to all spices, would need be based on the assumption that the data of the petition are applicable to all varieties of spice, including those for which specific data are lacking. They probably are, but due conservatism would dictate that such probability be not assumed unless necessary. Petitioner is enjoying the collaboration of the largest spice dealer in the country. The latter is in position to obtain data now lacking on other varieties of spice. We think it would be good strategy, in the consumer interest, to establish a tolerance of 250 ppm, across the board, on all spices for which supporting data are available. Petitioner would then doubtless seek extension of such tolerance to other varieties, and submit supporting data as soon as he obtains them.

We recommend, therefore, that a tolerance of 250 ppm be established for:

ginger	thyme	celery seed	white pepper
cassia	basil	mace	chili
red pepper	turmeric	rosemary	coriander
allspice	cloves	oregano	cumin
caraway	black pepper	savory	poppy
anise	paprika	cinnamon	bay
nutmeg	dill	marjoram	sage

Petitioner should revise the petition to request a tolerance of 250 ppm and withdraw fennel, mustard, cardamon, fenugreek, spearmint, peppermint, and parsley, and should revise his recommendation to fumigators of spice with HCN to substitute a 6-day aeration interval in lieu of an interval of from 24-72 hours.

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FAVorhes:llw 2/11/57

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